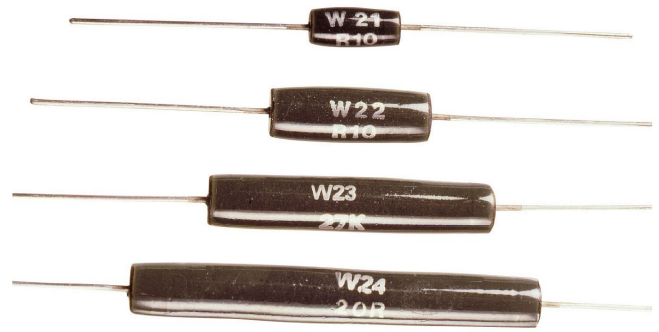


Features:

- IECQ-CECC approved
- Suitable for harsh environments
- Impervious lead-free vitreous enamel coating
- Overload characteristics ideal for protection circuits
- High stability and reliability
- High power dissipation for size



All parts are Pb-free and comply with EU Directive 2011/65/EU amended by (EU) 2015/863 (RoHS3)

Electrical Data

W20 Actual Data		W21	W22	W23	W24
Power rating @25°C	W	3	7	10.5	14
Resistance range	ohms	R10 to 10K	R10 to 22K	R15 to 60K	R20 to 100K
Resistance tolerance	%	<R50: 5 ≥R50 to <1R0: 2, 5	≥1R0: 1, 2, 5	<1R0: 5 ≥1R0: 1, 2, 5	
TCR (-55 to 200°C)	ppm/°C	±200 (typically ±75)			
Limiting element voltage	V	100	200	500	750
Standard values		E24 preferred. Other values may be requested.			
Thermal impedance	°C/W	88	44	29	22
Ambient temperature range	°C	-55 to 200			

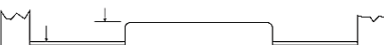
The requirements of the following standard are met or exceeded by the corresponding W20 series products above.

IECQ-CECC 40201-002 requirements		JB	KB	LB	MB
Required power rating @25°C	W	2.9	7	10.5	14
Required power rating @70°C	W	2.5	6	9	12
Qualified resistance range	ohms	R10 to 10K	R10 to 20K	R15 to 56K	R20 to 100K
Required resistance tolerance	%	<R50: 5 ≥R50 to <1R0: 2, 5	≥1R0: 1, 2, 5	<1R0: 5 ≥1R0: 1, 2, 5	
Required TCR (-55 to 200°C)	ppm/°C	≥5R to <10R: ±400 ≥10R: ±200			

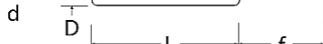
Physical Data

Dimensions in mm and weight in g					
Type	L _{max}	D _{max}	f _{min}	d _{nom}	Wt. _{nom}
W21	12.7	5.6	22.75	0.8	1
W22	22	8	23.1		2.6
W23	38		30		4
W24	53.5				6.1

W21 & W22



W23 & W24



Construction

A high purity ceramic substrate is assembled with interference fit end caps to which are welded the termination wires. The resistive element is wound on the substrate and welded to the caps; the vitreous enamel protective coating is then applied.

Terminations

Terminations are copper clad steel wire, nickel plated and solder-coated. They meet the strength requirements of IEC 60115-1 clause 9.5 and the solderability requirements of IEC 60115-1 clause 11.1.

Marking

The resistors are legend marked with type reference, resistance value and tolerance. Values are marked in accordance with IEC 60062.

Solvent Resistance

The body protection and marking are resistant to all normal industrial cleaning solvents suitable for printed circuits.

Flammability

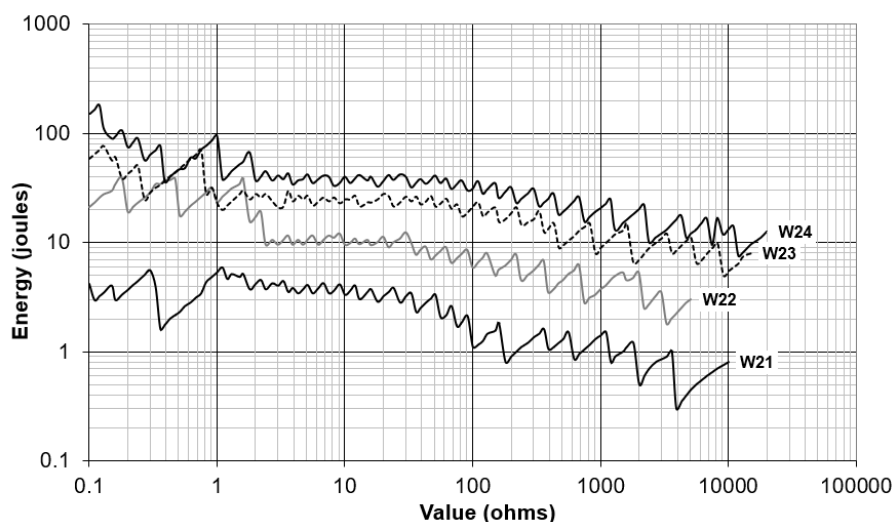
All materials used in the construction of W20 series resistors are inorganic and inherently non-burning.

Performance Data

		IECQ-CECC 40201-002 Requirements	Actual Performance	
			Maximum	Typical
Load at full rated power: 1000hrs @25°C	±ΔR%	Not specified	5	3.5
Load at IECQ-CECC rating: 1000hrs @25°C	±ΔR%	5	5	3.5
Dry heat: 1000hrs @200°C	±ΔR%	5	2	1
Shelf-life: 12 months at room temperature	±ΔR%	Not specified	0.03	0.02
Short-term overload	±ΔR%	1	1	0.2
Climatic	±ΔR%	5	0.5	0.2
Climatic category		55/200/56		
Long-term damp heat	±ΔR%	5	0.05	0.02
Temperature rapid change	±ΔR%	1	0.5	0.2
Resistance to solder heat	±ΔR%	1	0.25	0.03
Vibration & bump	±ΔR%	1	0.25	0.05
Noise (in a decade of frequency)	μV/V	Not specified	No measurable excess noise	
Robustness	±ΔR%	1	0.4	0.05
Insulation resistance	ohms	Not specified	>1G0	
Voltage proof	V	Not specified	500	

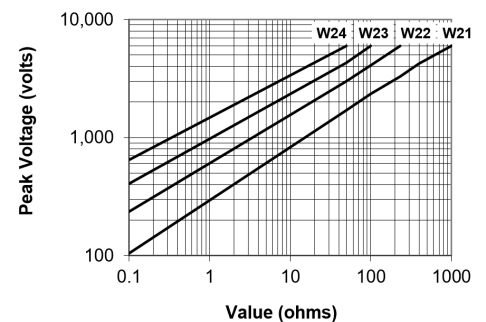
Pulse & Overload Performance

Pulse Energy Capacity

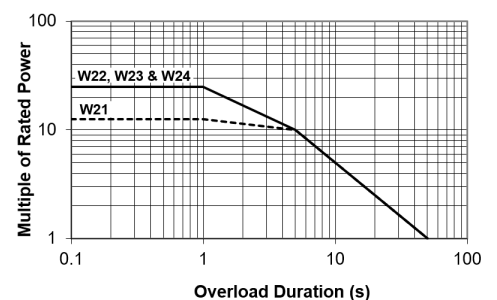


1.2/50μs Surge Voltage

(50 surges, alternating polarity, |ΔR| < 2%)



Overload



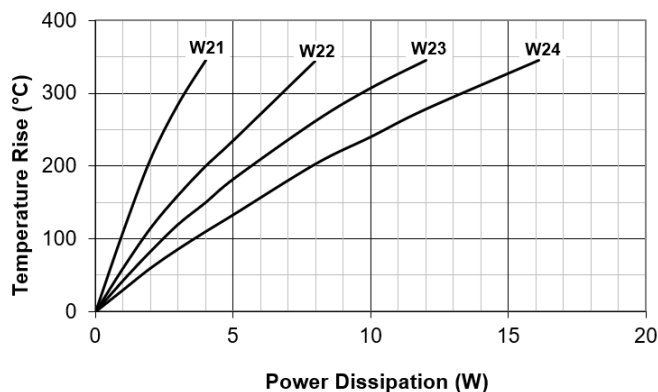
For pulse durations <0.1s the Pulse Energy Capacity graph should be used. For longer durations the Overload graph applies.

For full details see:

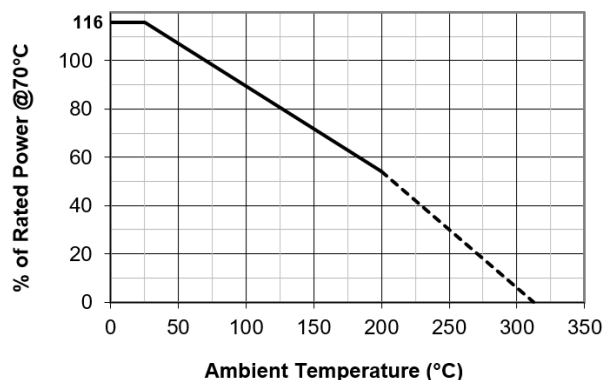
<https://www.ttelectronics.com/TTElectronics/media/ProductFiles/Application-Note/Wirewound-Pulse-Overload-Resistors.pdf>

Thermal Performance

Temperature Rise



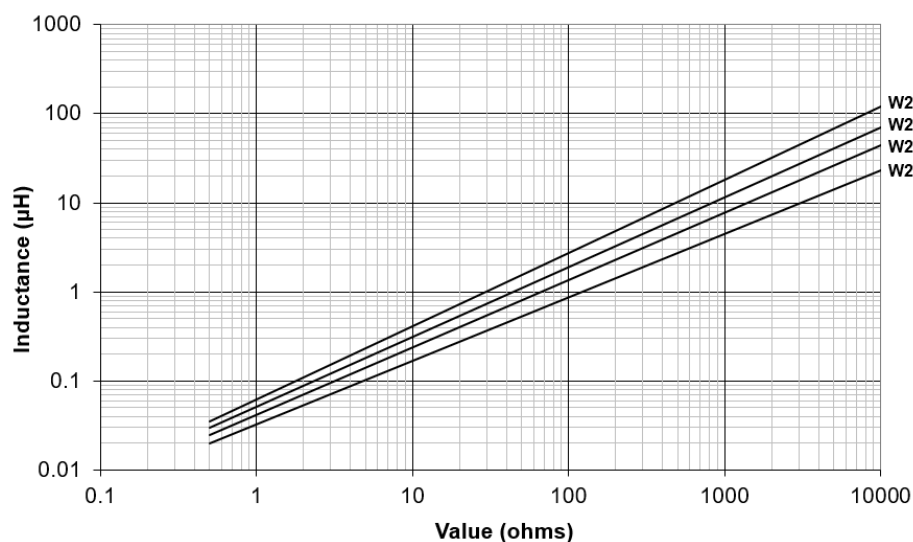
Temperature Derating



Inductance

This graph is based on calculations verified by measurements at 10kHz. It should be treated as indicative.

Typical Inductance



Application Notes

The termination should not be bent closer than 1.6mm from the body, and the recommended minimum bend radius is 1.2mm.

The terminations are not solderable within 4mm from the body. Custom parts with solderability closer to the body may be requested.

When cold, vitreous enamel has excellent insulation resistance. In common with all insulants the specific resistance of the enamel decreases with increase in temperature. Therefore, resistors operated at near maximum temperature cannot be classed as insulated and should not be used in contact with any conducting material.

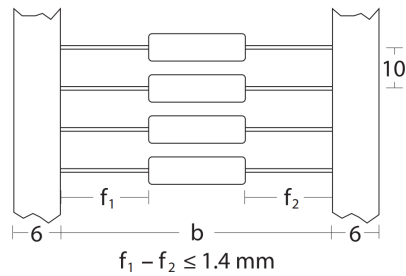
Care must be taken when determining clearance distance between the resistor body and the PCB or other components to ensure these are not over heated.

Resistance is measured 6mm from the body.

W20 Series

Packaging

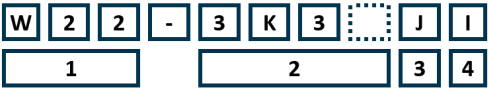
For W21 the standard method of packaging is taped in ammo packs. For W22 the standard method of packaging is taped and reeled. Taping dimensions (in mm) are shown below. W23 and W24 parts are available only as loose packed in boxes.



Type	b
W21	63 ±2
W22	73 ±2

Ordering Procedure

Example: W22-3K3JI (W22 at 3.3 kilohms ±5%, Pb-free)



1	2	3	4		
Type	Value	Tolerance	Packing & Termination Finish		
W21	E24 = 3/4 characters	F = ±1%	I	All types	Standard packing, Pb-free
W22	R = ohms	G = ±2%	Standard Packing		
W23	K = kilohms	J = ±5%	W21	Ammo	1000/box
W24			W22	Reel	700/reel
			W23 & W24	Bulk	50/box

Note: For IECQ-CECC released product follow the MPN with text indicating the relevant release and style. Note that this additional text does not form part of our MPN.
Example: W22-3K3JI IECQ-CECC40201-002 KB